REMARKS

Claims 1-30, 32-39, 41-43 and 46 are all the claims pending in the application. Claims 1-3, 32-39, 41-43 and 46 presently stand rejected. Claims 1, 14, 27, 29, 34, and 46 are independent claims.

Claim Rejection Under 35 U.S.C. § 102

Claims 1-9, 11, 13-26, 41 and 46 are rejected under 35 U.S.C. § 102(b) as being unpatentable over Walters et al. (US 5,388,445).

Independent claim 1

With respect to independent claim 1, Applicant has amended the claim to recite a step of calculating a "time of flight."[1] Although Applicant disagrees with the Examiner, as a path of least resistance, Applicant has amended the claim to clarify the nature of the "transmission" claimed – in this regard, "transmitting" has been changed to --emitting-- to avoid uncertainty of whether "transmission" is akin to generation of a signal or conduction of a signal in a medium. It is now clear that the recited emitting requires actual generation of the recited signals.

Claim 1 recites a method including:

emitting a first signal comprising at least one characteristic waveform feature;

emitting a second signal comprising at least one corresponding characteristic waveform feature and a waveform modification introduced at a predetermined point in time of the duration of the second signal;

receiving said first and second emitted signals;

[1] The omission of this step was noted by the examiner under items 5 and 6 of the Office Action.

determining a time of reception of the introduced waveform feature modification in the second signal by comparing the respective waveforms of the first and second signals and determining a point of diversion between corresponding characteristic waveform features of the first and second received signals comprising super positioning said first and second received signals; and

determining a time of flight of the introduced waveform modification based on the determined time of reception of the introduced waveform feature and its time of emission.

Applicant respectfully requests the Examiner to withdraw the rejection of independent claim 1 at least because Walter does not disclose all of the recitations of this claim.

1. Emitting of Signals

Walters discloses a method of "detecting a wave front caused by the onset of leaks or other transient events in a pipeline" and a "method to "determine the arrival time and/or amplitude of the wave front." See Walters at 1:15-22. Thus, Walters is a "responsive" system in the sense that it merely monitors a pipe and responds to what is occurring in the pipe, but *does not emit signals* into the pipe. Thus, there is no "transmitter" used in Walters and the time of creation of the pressure wave is not known in Walters, so "time of flight" is not, and cannot be determined using the method taught therein.

2. Signals having at least one characteristic waveform feature

In addition, the method of claim 1 specifically recites to features of the waveform – i.e. the shape of the time varying quantity, and more specifically a characteristic portion of that waveform. In contrast the pressure signals in the pipe in Walters do not possess a "corresponding characteristic waveform feature." Rather, in Walters, in a first time period a

random pressure noise is generated (1:35, FIG. 3, and 9:25-- "Reference Line" in FIG. 7). By definition, this pressure noise does not have a "characteristic waveform;" instead it will have an unknown and random waveform.

Applicant respectfully submits that "waveform" is not the same as a "wave". The term "waveform" is a reference to the shape of the wave in the time domain i.e. the time varying amplitude of a quantity – for example it might be sinusoidal, square etc. A "characteristic waveform" is not the same as "a waveform characteristic". The characteristic waveform is a characteristic wave shape that each signal has. For example, in the embodiments illustrated in the specification a *square* characteristic waveform is used. In contrast, Walters does not have such a characteristic waveform – Walters merely has a signal dominated by "random pressure noise", as shown in FIG. 3. This random noise cannot be considered as corresponding to a characteristic waveform.

The other source of pressure fluctuations in Walters is the "operation of valves, start-up or shut-down of pumps, or a break in the pipeline." See Walters at 1:23. This results in a pressure change in the pipeline that propagates through it. Walters does not teach that the waveform caused by such event is known or has some characteristic waveform shape. Rather it is merely a change in pressure caused by some event in the pipeline and cannot be said to possess a "characteristic waveform feature".

Applicant also respectfully submits that Walters does not emit any "second signal", nor does any second signal exist which has "at least one characteristic waveform feature". Similar arguments apply to those presented above in relation to the first signal.

3. Waveform modification

Moreover the Examiner appears to be citing that the pressure wave caused by the event in Walters is "a waveform modification".[2] However this event is essentially an environmental effect that the method seeks to identify. Thus, even if the event is considered to be a waveform modification it cannot correctly be said to be "introduced at a predetermined point in time of the duration of the second signal".

4. Determining an arrival time of the introduced waveform feature modification

Walters does not perform a step of "determining an arrival time of the introduced waveform feature modification in the second signal by comparing the respective waveforms of the first and second signals." Rather, Walters determines time of arrival of a pressure front by extrapolating a best fit line from two time periods (the "reference line" and "current line") of the same signal (namely the signal representative of random pressure noise in the pipeline) and identifying a point of change between the two lines. The "waveforms" are entirely ignored in Walters (by smoothing them with a line of best fit), essentially because they represent noise that is masking the signal that Walters is looking for.

With respect to this feature, the Examiner has asked where the feature "comparing the respective waveforms of the first and second signals" is supported in the specification.[3] Applicant respectfully directs the Examiner's attention to the section of the specification headed

[2] See Office Action at page 2.

[3] See Office Action at page 28.

"Locating the Diversion point in software" on Page 36, lines 11-24, of the specification. FIG. 37 also illustrates the recited comparison.

In view of the comments above, Applicant respectfully submits that independent claim 1 is patentable.

Independent Claims 14 and 46

The applicant submits that the arguments in relation to claim 1 also apply to claims 14 and 46, as amended, and respectfully requests the Examiner to withdraw the rejection of independent claim 14.

For the reasons discussed above, Walters does not disclose e*mitting first and second signals*, where both signals comprise at least one characteristic waveform feature and the second signal further comprises a waveform modification introduced at a predetermined point in time of the duration of the second signal. Moreover, Walters only considers a single received signal, and does not compare the waveform of two signals or (even parts of a single signal). Thus Walters cannot look for a "point of diversion between corresponding characteristic waveform features" in the two signals as claimed.

Dependent Claims 2-9, 11, 13, 15-26, and 41

Applicant respectfully submits that dependent claims 2-9, 11, 13, 15-26, 41, and 46 are patentable at least because of their dependency from claim 1 or claim 14. Moreover, Applicant provides the following arguments with respect to these dependent claims.

Moreover, with respect to dependent claims 3 and 16, Walters is a "responsive" system in the sense that it merely monitors a pipe and responds to what is occurring in the pipe, but

does not emit signals into the pipe – this is a fundamental difference. This difference means that Walters does not teach "calculating the difference between the time of the ***point of diversion*** and the ***time of transmission*** of the introduced waveform feature modification". It cannot do so because the time of transmission of the wavefront being detected is not known because it occurs outside the system of Walters.

With respect to claim 5, Walters merely teaches a windowing of groups of successive samples to work out a localized (in time) line of best fit to the pressure values in each window – only a single signal is received – not a plurality as believed by the Examiner.

With respect to claim 7, the waveform of the received signal is ignored by Walters – instead it fits a line to the received signal. This difference is highlighted in the passage noted by the Examiner at 9:24-28 of Walters – rather than disclosing anything about a characteristic waveform this passage is talking about noise, which by definition does not have a characteristic waveform.

With respect to claim 10, Walters teaches nothing regarding a the phase of any wave or signal.

With respect to claim 11, Walters' signals *are not in any way ultrasonic* – ultrasonic signals are typically understood to be sound waves having a frequency above the range of human hearing, namely above 20 kHz. In fact, only relatively low frequencies are disclosed in Walters. For example – Walters teaches at 11:68 that the maximum frequency signal is 1000 Hz.

With respect to dependent claims 19 and 21-24, Walters does not teach "signal transducing means for transmitting and receiving a plurality of first signals." Instead, the transducers of Walters *are only used as receivers*.

Claim Rejections Under 35 U.S.C. § 103

Walters and Hill

Claim 12 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Walters in view of Hill et al. (US 5,131,052).

Applicant respectfully submits that claim 12 is patentable at least because of its dependency from claim 1.

In addition, although the Examiner is correct that Hill states "The loudspeaker of this embodiment, generally referred to as mid-range speaker, is intended to operate over a frequency range of approximately 150 kHz to 6 kHz." at 3:58-61, it is clear from the rest of Hill that this is an error. At each other place in that specification the equivalent range of operation is taught as *150 Hz to 6 kHz* – see Claim 10, 12, 1:15, 2:61; 5:22, and 6:50. The person of ordinary skill in the art would automatically recognize and correct this error.

Even if the examiner were to maintain his interpretation of Hill (which the Applicant maintains is incorrect), Hill does not disclose that the speaker disclosed therein has "transducers driven at resonant frequencies in a frequency range of about 60 kHz to about 90 kHz" as claimed. The *signal used to drive the speakers* in Hill is disclosed at 5:22 as being in a frequency range of 150Hz to 6kHz – that is, the signal from the amplifier which is provided to the speaker in Hill is outside the claimed range.

Moreover, Walters and Hill are fundamentally incompatible and would not be combined by one skilled in the art. Walters does not include a speaker at all, and only seeks to receive signals propagating in the pipeline and to determine when such signals are received. The signals received in Walters are caused by "onset of leaks or other transient events in a pipeline". Thus there is no reason why one of ordinary skill would use the speaker of Hill with the system of Walters.

Schoenfelder and Walters

Claims 29, 32 and 34-39 are rejected under 35 U.S.C. § 102(b) as being unpatentable over Schoenfelder et al. (EP 1 006 500) in view of Walters.

Claims 27, 28, 33 and 42 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Schoenfelder in view of Walters.

Independent Claim 29

There is no reasonable combination of Schoenfelder and Walters that would meet the claimed method of detecting one or more blocked sampling holes in a pipe of an aspirated smoke detector system including:

> comparing the subsequent flow with the base flow, and indicating a fault if the difference between the base flow and the subsequent flow exceeds a predetermined threshold.

Schoenfelder teaches a method of detecting airflow in a spot or point type detector – not detecting one or more *blocked sampling holes in a pipe of an aspirated smoke detector system*, as claimed. Schoenfelder merely teaches detecting a flow rate using a thermal flow sensor 38a. The output of this flow sensor is compared to a threshold. The threshold is determined based on

the output of a similar, ambient thermal sensor 38b. This process is repeated at intervals to determine correct operation (e.g. 4 hourly – see step 148).

However, Schoenfelder does not, *compare a base flow and subsequent flow levels*, as claimed, nor does it "[indicate] a fault if the difference between the base flow and the subsequent flow exceeds a predetermined threshold". Rather Schoenfelder compares a detected flow rate to the predetermined threshold that is based on an ambient temperature level. These are different processes.

Thus, Applicant respectfully submits that independent claim 29 is patentable.

Independent Claim 27

There is no reasonable combination of Schoenfelder and Walters that would meet the claimed method monitoring flow through a particle detector of an aspirated smoke detector system, including:

> *comparing the subsequent flow with the base flow*, and indicating a fault if the difference between the base flow and the subsequent flow exceeds a predetermined threshold wherein base flow and subsequent flow are determined at respective times according to the following general flow calculation:
>
> f = S x A
>
> where f = *volumetric flow*;
>
> A = cross sectional area of an air flow path through the detector system;
>
> s = speed of air through the detector system …

Schoenfelder et al. teaches a method in which fluid flow is measured. The flow rate is repeated at certain time intervals hence a base flow and subsequent flow levels (see 4.3) can be said to be measured.

As discussed above with respect to independent claim 29, Schoenfelder does not, *compare a base flow and subsequent flow levels*, as claimed, nor does it "[indicate] a fault if the difference between the base flow and the subsequent flow exceeds a predetermined threshold".

Moreover, there is no teaching that the claimed flow calculation can be performed by Schoenfelder (or Walters). The claimed flow calculation is not compatible with the teaching of Schoenfelder. Schoenfelder measures flow using thermal means, as discussed above. This type of measurement generates a *mass flow rate* – i.e. a flow rate that indicates the amount of mass passing a point in a given time, which might be measured in kgs^{-1}. The claim is limited to a calculation using a *volumetric flow rate*. A volumetric flow indicates what volume of air is passing a point over a given time, e.g. as measured in Ls^{-1}. Mass flow and volume flow are different and mass flow will vary with things like temperature and density, whereas volumetric flow will not vary in this way.

Walters does not remedy any of the deficiencies of Schoenfelder in this regard. Moreover, the claimed calculation includes signals transmitted in a forward direction and reverse direction – this additional feature is not taught by Walters.

Thus, for the reasons discussed above, Applicant respectfully submits that independent claim 27 is patentable.

Dependent Claims 28, 30, 32-39, and 42

Applicant respectfully submits that dependent claims 28, 30, 32-39, and 42 are patentable at least because of their dependency from claim 27 or claim 29. Moreover, Applicant has provided the following additional arguments with respect to these claims.

With respect to dependent claim 30, there is no disclosure of an ultrasonic flow sensor. The *flow sensor* of Schoenfelder operates on a thermal principle, not on the use of sound waves – Col., 6 para [0042], teaches that the flow sensors 38a and 38b are thermistors. The alarm or siren horn specifically identified cited by the examiner is not an ultrasonic flow sensor. The siren or horn must be *heard* by people to be effective in alerting them to the presence of a fire – it should not be an ultrasonic device. Moreover in Schoenfelder, this siren horn is not used to detect airflow – is it used to notify people of a fire condition.

With respect to claim 32, Schoenfelder does not teach any comparison of one measurement with a corresponding subsequent measurement – rather the same flow measurement is repeated (e.g. 4 hourly – see step 148) and each time compared with a threshold – not a base flow rate.

With respect to claim 34, Schoenfelder teaches a system for detecting correct airflow in a spot or point type detector – not detecting one or more blocked sampling holes in a pipe of an aspirated smoke detector system. Specifically Schoenfelder does not disclose a smoke detector that is connected to sampling network as claimed. Moreover, the alarm or siren horn cited by the Examiner is not an ultrasonic flow sensor.

Since there is no sampling network taught in Schoenfelder the claims 34-37 should also be considered patentable, as each claim introduces a further recitation with reference to the sampling network.

With respect to claim 39, there is no bypass path taught in Schoenfelder – all air drawn into the system goes into the sampling chamber.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

/John M. Bird/

John M. Bird
Registration No. 46,027

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
23373
CUSTOMER NUMBER

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